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Contributions to the lichen flora of the Hengduan Mountains, China 1. Genus *Pseudephebe* (lichenized *Ascomycota, Parmeliaceae*)

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Abstract — *Pseudephebe pubescens* is reported, described and illustrated from the Chinese Hengduan Mountains region. It is characterized by its slender and isotomic-dichotomous branched filaments forming tiny cushions, a cortex of longitudinally oriented hyphae that become prosoplectenchymatous at the surface, medullary hyphae that are not ornamented, and the absence of lichen substances. It grows on arctic-alpine rock.

Key words — alpine lichens, Sichuan, taxonomy, thallus anatomy, Xizang

Introduction

The Hengduan Mountains are part of the Himalayas located in southern China, including western Sichuan, northwestern Yunnan, and southern Xizang (Tibet). This mountain range has an area of ca. 364,000 km^2. The region has one of the highest biodiversities of lichens in the world. In recent decades, many interesting lichens were found in the region (McCune et al. 2003, Jørgensen 2003, Obermayer 1997, 2001, 2003, 2004; Wang et al. 2001, 2003, 2005; Xiao et al. 2006, Niu et al. 2007, 2008). Although we began our taxonomic work under the series entitled "Taxonomic study on the lichen genus *Bryoria* (lichenized *Ascomycota, Parmeliaceae*) from the Sino-Himalayas" (Wang et al. 2006), we prefer to title the new series as in the present paper, because the Hengduan Mountains form a more distinct biogeographical region than the Sino-Himalayas. In this paper, the genus *Pseudephebe* is reported from the Hengduan Mountains as new for China.

Materials and methods

The four specimens were collected in W-Sichuan and S-Xizang between 2001 and 2007. The collections were annotated and photographed in the field. Descriptions of external morphology were based on air-dried materials observed under a dissecting stereomicroscope. Sections were made with a razor blade under the stereomicroscope, and mounted in GAW (glycerol: ethanol: water=1:1:1). SEM micrographs were obtained with the scanning electron microscope JEOL JSM-5410 LV of National Instrumentation Center for Environmental Management, Seoul National University. Thin-layer chromatography (TLC) was performed to identify lichen chemical compounds with three developing solvent systems (Culberson 1972). The specimens used in this study are deposited in the Cryptogamic Herbarium, Kunming Institute of Botany, Academia Sinica (KUN).

Taxonomy

Pseudephebe M. Choisy, Icon. Lich. Univ. ser. 2, fasc. 1: [sine pag.] (1930).
Type species: *Pseudephebe pubescens*

Thallus fruticose, appressed to the substrate; branching isotomic-dichotomous, the branches terete but tending to become dorsiventrally compressed in one species, even or uneven, brown to black, dull to shiny; cortex of longitudinally oriented hyphae which become prosoplectenchymatous at the surface; medullary hyphae not ornamented. Apothecia lateral; thalloid margin concolorous with the thallus, sometimes ciliate, asci clavate; spores 8, ellipsoid, hyaline, simple, 7–12 x 6–8 µm. Pycnidia common. Lichen products absent.

Only two species of this genus are known worldwide (Brodo & Hawksworth 1977, Nash et al 2002: 409-411).

Pseudephebe pubescens (L.) M. Choisy, Icon. Lich. Univ., ser. 2, 1: [sine pag.] (1930). Figs. 1–3
≡ *Lichen pubescens* L., Sp. Pl. 2: 1155 (1753).
≡ *Alectoria pubescens* (L.) R. Howe, Classif. Usneac. Amer.: 23 (1912).

Thallus fruticose, decumbent to subpendulous, forming small cushions, loosely adnate, more or less circular c. 2–12 cm diam., brown to blackish brown, smooth, dull to slightly shining; main branches slender, cylindrical, uneven, 0.1–0.2 mm diam., 0.05–0.1mm near the tips; branching frequent, isotomic-dichotomous, not flattened; sometimes with circular pits presented on the surface (Fig. 2); true lateral spinules, soredia, isidia and pseudocyphellae absent; Cortex 50 µm thick, 2-layered, with rectangular to irregular and knobby cells at the surface; medulla white, medullary hyphae not ornamented (Fig. 3). Apothecia not seen. Pycnidia common on tubercles, especially near the axils

Fig. 1. Habit of *Pseudephebe pubescens* in its natural habitat in Sichuan, China (photograph by Wang, 5 June 2006, voucher: Wang Li-song 06-26090).

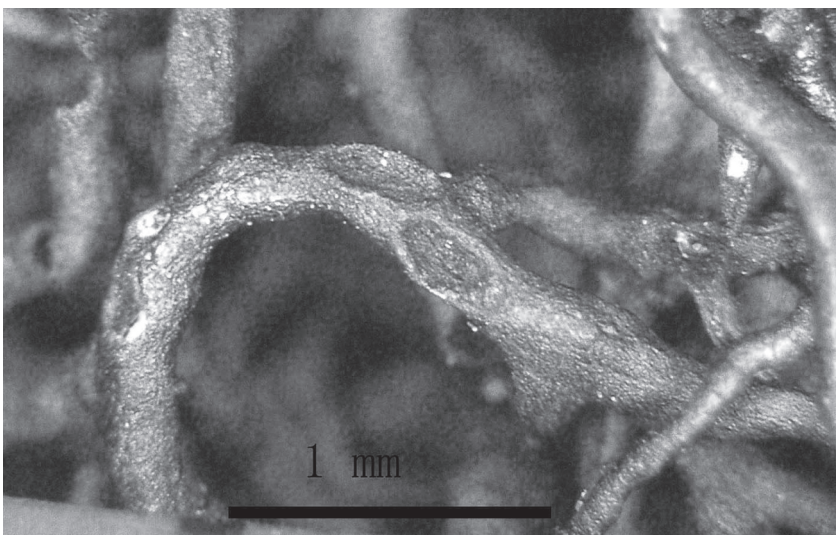

Fig. 2. Close-up of the thallus of *Pseudephebe pubescens*, showing uneven main branch sometimes with circular pits on the surface of the cortex (under the dissecting stereomicroscope; Wang Li-song 06-26090).

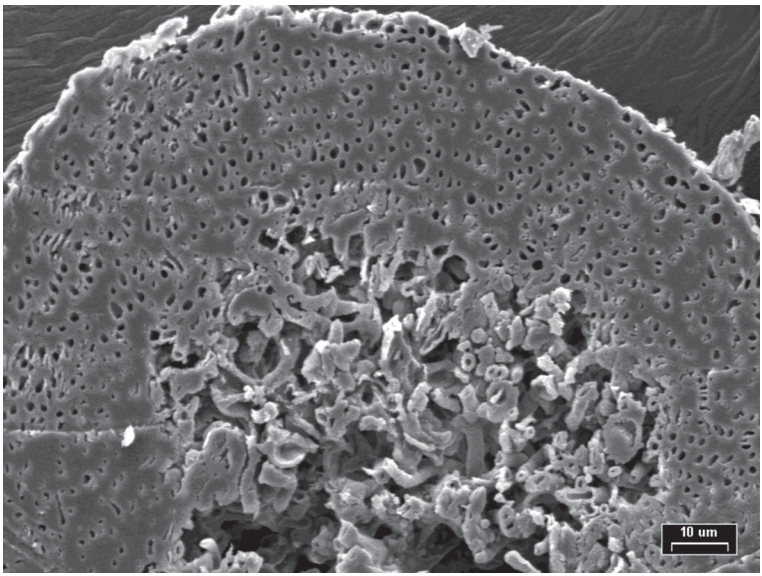

Fig. 3. Cross section of the main branch of *Pseudephebe pubescens* under SEM (Wang Li-song 83-2152a).

and bases, dark brown to black, 0.5–0.7 mm diam., conidia bifusiform, 6–7.5 x 1–2 μm, colorless. Photobiont: green algae. Cortex and medulla: K–, C–, KC–, P–; no lichen substances detected by TLC.

Habitat and ecology —Thallus loosely attached on siliceous rock surfaces, forming small cushions (Fig.1). All collections were from the alpine zone, between 4330 and 5070 m elevations in the Hengduan Mountains. Associated species included *Umbilicaria indica*, *Ophioparma ventosa*, *Rhizoplaca chrysoleuca* and *Rhizocarpon* spp.

Distribution —*Pseudephebe pubescens* is widely distributed. It is found in Europe (Hawksworth 1972), North America (Brodo & Hawksworth 1977), California (Nash et al. 2002: 409-411), the Alaskan arctic slope (Thomson 1979: 240-241), Japan (Kurokawa et al. 1968, 1981), and the southern hemisphere (Brodo & Hawksworth 1977). It is new to China (Fig. 4).

Specimens examined—**CHINA. Sichuan** Prov., Kingding County, Zheduoshan Mt., 30° 04' N, 101° 48' E, 4200–4330 m, on rock, Wang Li-song 06-26090, 07-29009; Muli County, Sanqu village, 4400 m, on rock, Wang Li-song 83-2152a; **Xizang** (Tibet) Prov., Naidong County, 28° 37' N, 92° 13' E, 5070 m, on rock, Wang Li-song 07-28595 (Fig. 4). Additional specimens examined: numerous North American specimens and Finland: Lapponia enontekiensis(le). Enontekio, Hetta, Jyppyra, ad rupem in summon monte. 21 VII 1957, Coll. A. J. Huuskonen (no number).

Comments —The main branches are wider (0.2–0.5 mm diam.) in specimens from the Alaskan arctic slope (Thomson 1979: 240-241) than in the Chinese materials, where they are only 0.2 mm in diam.

This species differs from *Pseudephebe minuscula* (Nyl. ex Arnold) Brodo & D. Hawksw. in that the latter has somewhat flattened branches and shorter internodes (Brodo & Hawksworth 1977). The two species do, however, tend to integrate. Although the Chinese specimens are somewhat smaller and have shorter internodes than typical *P. pubescens*, the absence of distinctly flattened branches indicates *P. pubescens*.

In North America *P. minuscula* tends to have a more continental distribution than *P. pubescens* (Brodo & Hawksworth 1977). Although the climate of the Hengduan Mountains has no close analog in North America, the Hengduan Mountain region is influenced by both continental and maritime air masses, offering a wide range of habitats for alpine lichens. The abundance of cyanolichens at lower elevations in some parts of the Hengduan Mountains suggests a suboceanic climate.

The genus *Pseudephebe* is close to the genus *Bryoria* Brodo & D. Hawksw., which also contains fruticose alpine species found on rocks from the Hengduan Mountain region. For example, *Bryoria nitidula* and *B. tenuis* are similar to *Pseudephebe* in having a dark brown to blackish thallus and medullary hyphae that are not ornamented. However, the alpine *Bryoria* species on rock are

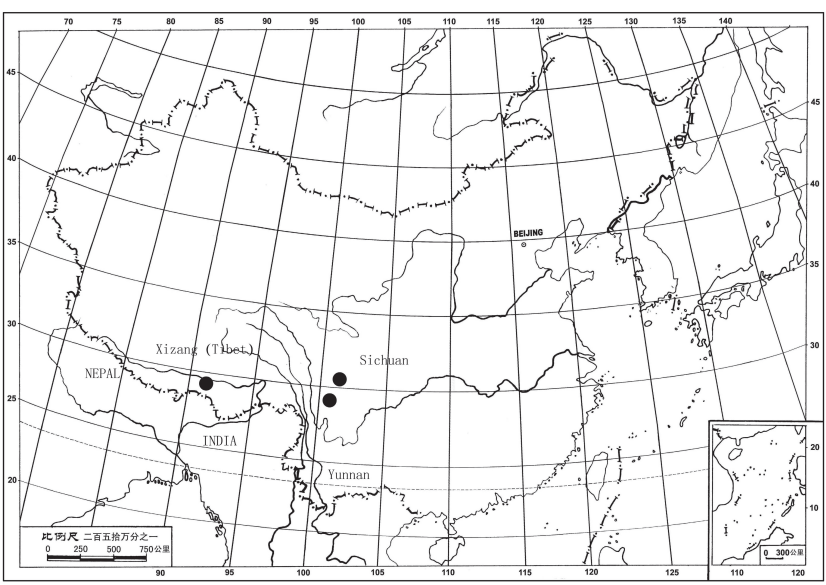

Fig. 4. Distribution of *Pseudephebe pubescens* in China.

usually larger (branches >3 cm long), have an erect to caespitose thallus and often have pseudocyphellae. Furthermore, they usually contain the substances atranorin or fumarprotocetraric acid.

Acknowledgments

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